Explanation of Faraday's Experiment

by the Time-Space Model of Wave Propagation

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ABSTRACT

It is shown by the means of Time-Space Model of Wave Propagation the underlying phenomena of the alternating current's origin in famous Faraday's experiment.

Keywords: Electromagnetism, Wave Equation

The Time-Space Model of Wave Propagation is applied to the description of fluctuation phenomena both in physics and in economics [1, 2, 3].

In this paper the Model is applied to the Faraday's experiment of rotating a rectangular conducting loop in a magnetic field [4].

Magnetic field represents the energy's level in the Model terminology. We choose two points on the opposite sides of a loop (see **Fig. 1**) and calculate the induced values of energy's disturbances.

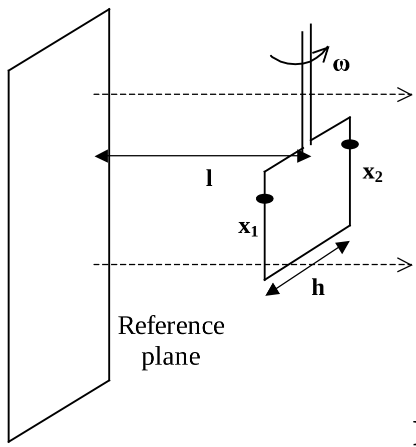

Fig. 1

Some other values are also shown on **Fig. 1** as side h of the loop, distance l from loop's center to the "reference plane", which is perpendicular to the energy's level gradient changes, and an angular speed ω of loop's rotation.

Then the distances from x_1 and x_2 to the reference plane are

$$x_i = l + \frac{h}{2}\sin(\omega t + \varphi_i), \tag{1}$$

where $i = 1, 2$ and φ_i are the initial phases, $\varphi_2 = \varphi_1 + \pi$.

I suppose that the energy's values in both points x_1 and x_2 are equal,

$$U(x_1,t)=U(x_2,t) \tag{2}$$

for $\forall t$.

I also assume that the energy's level at the reference plane is equal everywhere $\Phi(0,t)$ and is distinct from the energy's level at rest Φ_0 on some value $\Delta\Phi_0$ i.e.

$$\Phi(0,t)=\Phi_0+\Delta\Phi_0 \,. \tag{3}$$

Therefore we can calculate the energy's levels in points x_1 and x_2 using [1],

$$\Phi(x_i,t)=\Phi_0+\Delta\Phi_0\cdot e^{-\mu x_i}\,, \tag{4}$$

where $\mu>0$ is some constant.

Thus the energy's disturbances at points x_1 and x_2 are

$$\Delta U(x_i,t)=\Delta\Phi_0\cdot e^{-\mu x_i}\,. \tag{5}$$

We can find the difference between the values of energy's disturbances in points x_1 and x_2 respectively,

$$\Delta U(x_1,t)-\Delta U(x_2,t)=2\cdot\Delta\Phi_0\cdot e^{-\mu l}\sinh\left(-\mu\frac{h}{2}\sin(\omega t+\varphi_1)\right). \tag{6}$$

Changing in time difference between values of the energy's disturbances causes the energy's disturbance propagation, which is manifested in the form of alternating current in the loop.

References

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